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ABSTRACT

The Medumba consonant inventory includes plain and prenasalized bilabial trills /в, mв/, which contrast with bilabial stops. The trills occur most often before the central vowels /ᵾ ə/, while they are not attested before /u/.

The central vowel /ᵾ/ has a vowel posture that is particularly conducive to trilling of the lips: it does not form a circular opening, the corners of the mouth are drawn slightly apart, the lips are tensed, particularly at the corners of the mouth, and there is a narrow aperture between the lips. This suggests that it is close lip aperture of the following vowel—rather than rounding—that provides the most conducive environment for bilabial trill production.

Keywords: bilabial trill, vowel posture, lip position, Niger-Congo, Narrow Grassfields

1. INTRODUCTION

This paper is a preliminary assessment of the articulation and phonology of bilabial trills and vowels in Medumba (ISO 639–3 code byv), a Narrow Grassfields language spoken in and around the town of Bangangte in Cameroon.

Bilabial trills (excluding interjections) are found predominantly in Central Africa, Papua New Guinea, Vanuatu, China, and Brazil [9]. In Narrow Grassfields, they are attested in Babanki, Kom, Kuk, Medumba, Mfumte, Mungaka, Ngwe, and Oku [2, 4, 6, 7, 9, 15, 17, 19].

2. METHODOLOGY

For this paper, we worked with one speaker of Medumba, an educated female speaker about 35 years of age. We recorded a list of 120 words spoken in isolation, the ten vowels in isolation /i e ɛ ᵾ ə a u o ɔ ɒ/, and a few selected phrases. The words were chosen in order to include bilabial trill data, as well as examples of each vowel. Data were collected from two sources [5, 16], and they were verified by the subject. The words presented to the subject were mostly provided in the orthography developed by CEPOM (Centre d'Étude et de Promotion des Oeuvres Mèhdúmbà), a system with which the subject was familiar.

During the recording, the first author produced the gloss for each word in English, and then the speaker produced the word in Medumba twice.

The entire set of data was recorded in audio at 48k, 24-bit, using a Zoom H2 recorder, and saved as WAV files. A video was made of the bilabial trill data and the vowels in isolation. We used a Canon Vixia HF-M30 HD camcorder, set at 30 fps, progressive scan). Audio was captured during the video recording using an Audio Technica ATR3350 lapel microphone. The recording took place at the C.V. STARR-Middlebury School in Yaoundé.

3. SAMPLE WORDS

In (1) we provide a sample of monomorphemic words containing bilabial trills. The data are in the CEPOM orthography [16] and IPA [8], the latter transcription based on our recording.

(1)	*CEPOM*	*IPA*	*gloss*
	mbwə	mʙə́	goat
	mbwà’	mʙə̀ꝰ	sacred forest
	—	mʙə̂	first
	bwə̂’ə	ʙə́ʔə̄	owl
	bwə	ʙə̀	cola nut
	bwə̀’ə	ʙə̀ʔə́	nine
	—	ʙə̌ʒù	(to) plant
	—	ʙə́	give birth, ripen
	mbʉm	mʙᵾ́m	cowry, money
	mbʉ	mʙᵾ́	dog
	tʉbù	tʃᵾ́mʙᵾ́	mahogany
	—	ʙᵾ́	(to) greet
	bʉn	ʙᵾ́n	milk
	sə̀mbʉn	sə̀ʙᵾ́n	cassava
	biâ	ʙíâ	avocado
	bi	ʙí	knife
	bílɔ̀	ʙílɔ̀	pillow
	mbwogə	mʙógə́	fire

The speaker noted that the vowel in the word for ‘sacred forest’ should be [ə]. The glottal stop, written as <’> in the CEPOM orthography, is sometimes realized as creaky voice.

4. PHONEMIC STATUS

We found two minimal pairs between /b/ and /в/ in Medumba, as shown in (2) [20]:

(2) bə́ ‘be’
ʙə́ ‘give birth, be ripe’

bə́ʔ ‘break’
ʙə́ʔ ‘exceed’

Contrast is also attested before /o/, e.g. [mʙógə́] ‘fire’ vs. [làmbò] ‘lamp’. We have not found contrast between [b] vs. [ʙ] before /i/ or /ụ/, which suggests a partial neutralization of contrast in these environments.

It is possible that the bilabial trill could be interpreted as patterning as a |bw| sequence in the phonology, e.g. as McKee [14] has done for Mangbetu. Note that in the CEPOM orthography the trill is usually written <bw>. More research on interpretation and contrast is needed.

5. ARTICULATION

5.1. Prenasalization

In Medumba, bilabial trills are initiated by a period of bilabial closure. The closure can be entirely oral (a “plain” bilabial trill), or it can consist of a nasal closure followed by a brief oral closure (a “prenasalized” bilabial trill).

Table 1: Duration of initial oral closure and period in trill (two trill periods for each token).

	Duration of oral closure	Duration of period in trill
mʙ	33.1 (n=7)	42.6 (n=14)
s.d.	4.5	5.2
ʙ	156 (n=8)	38.7 (n=16)
s.d.	14.1	4.6

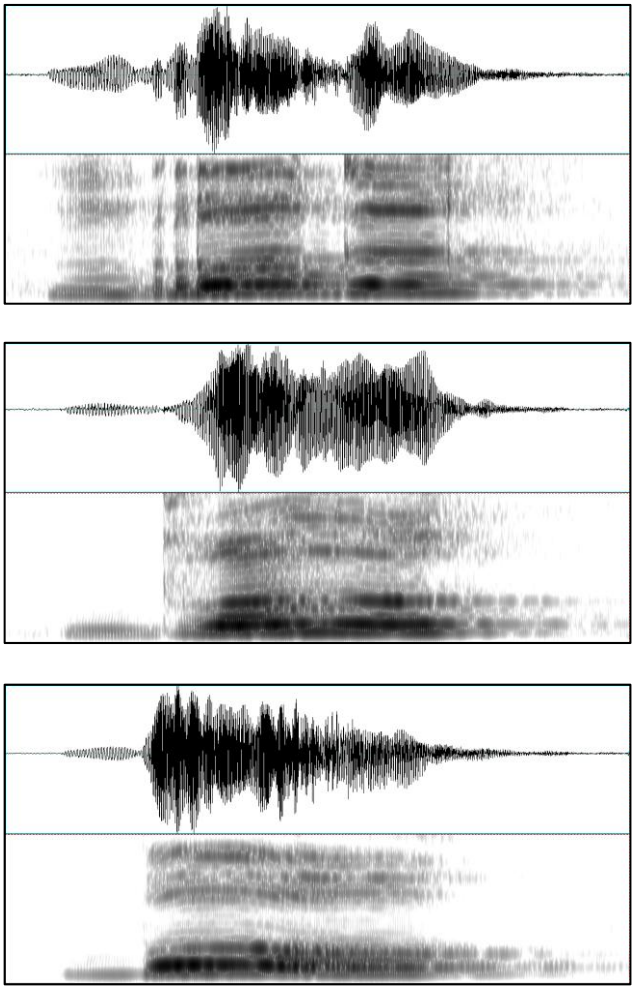
The phonological status of the nasal closure is somewhat unclear. Voorhoeve [20] treats it as a prefix, and marks tone on it (always low in his data). On the other hand, Nana et al. [16] do not mark tone and make no mention of the nasal closure’s status as a prefix. Prenasalization can occur word-medially in syllable-initial position, although this appears to involve cases of compounding.

The Narrow Grassfields languages in general have syllabic nasal prefixes which have been reduced from earlier whole open syllable prefixes [1]. In some languages (e.g. Limbum), these nasals have lost their syllabicity resulting in prenasalized consonants.

Measurements for seven prenasalized trills and eight plain trills are shown in Table 1. The duration of the oral portion of bilabial closure is given in the first column, and the duration of the period in the trill is given in the second column. Each token has two trill periods.

When the nasal closure is present, the oral closure is short, about 33 ms in duration. When prenasalization is not present, the oral closure is significantly longer, averaging about 156 ms. (This duration may be due to careful speech style.)

Figure 1: Waveforms and spectrograms of [mʙógə́] ‘fire’, [bβóŋə́] ‘poverty’, and [bóò] ‘two’.



5.2. Trilling

On average, there are two trill periods following the oral closure. Following Maddieson [13], we define the trill period as starting immediately at the release of the oral closure and ending at the completion of the next short closure, when there is a sudden rise in amplitude. A third partial lip closure is often observed corresponding to a partial reduction in amplitude.

The second column in Table 1 shows the duration of trill periods for /mʙ/ and /ʙ/. The mean duration of the trill period was slightly longer for /mʙ/ than for /ʙ/, i.e. 42.6 ms vs. 38.7 ms. Further work is

necessary to determine if this distinction is consistent across speakers of the language.

The voicing bar is present throughout the articulation of the bilabial trill.

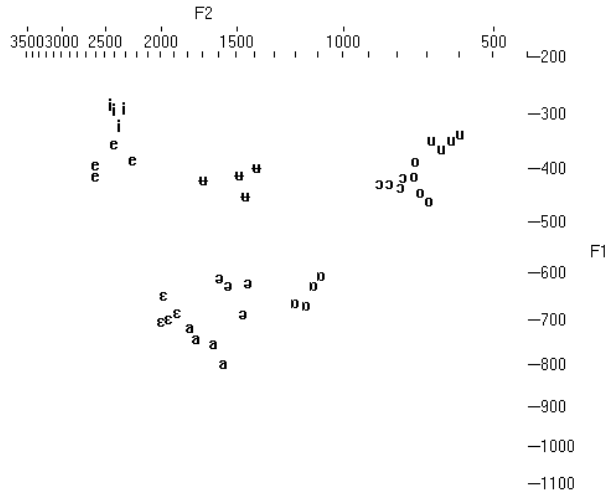
In line with Maddieson's observations, trilling occasionally fails. Figure 1 shows waveforms and spectrograms for three tokens: [mʙógə́] 'fire', [bβóŋə́] 'poverty', and [bóò] 'two'. A trill [ʙ] was expected in the second word, but it was realized as [bβ], with friction heard and aperiodic noise visible in the spectrogram.

6. PHONOTACTICS

The majority of bilabial trills in Medumba occur before the central vowels /ʉ̩/ and /ə/. In our data they also occur before /i/ and /o/, and they have been attested by other researchers before /ɔ/ [5]. We have found no cases of bilabial trills before the other vowels in Medumba. Of interest is its absence before /u/, since this is thought to be the most common environment for the genesis of /ʙ/ [10, 13].

Figure 2 shows an F1 vs. F2 plot of the ten vowels in Medumba for our speaker. There were four tokens of each vowel, from words where the vowel followed a bilabial consonant, and no nasal consonant was adjacent. The vowels were measured in PRAAT by identifying the midpoint of the steady state of the vowel on a spectrogram, ensuring congruency between the formant bands on the spectrogram and the LPC values, and then extracting the LPC values.

Figure 2: F1 vs. F2 plot of the vowels in Medumba.

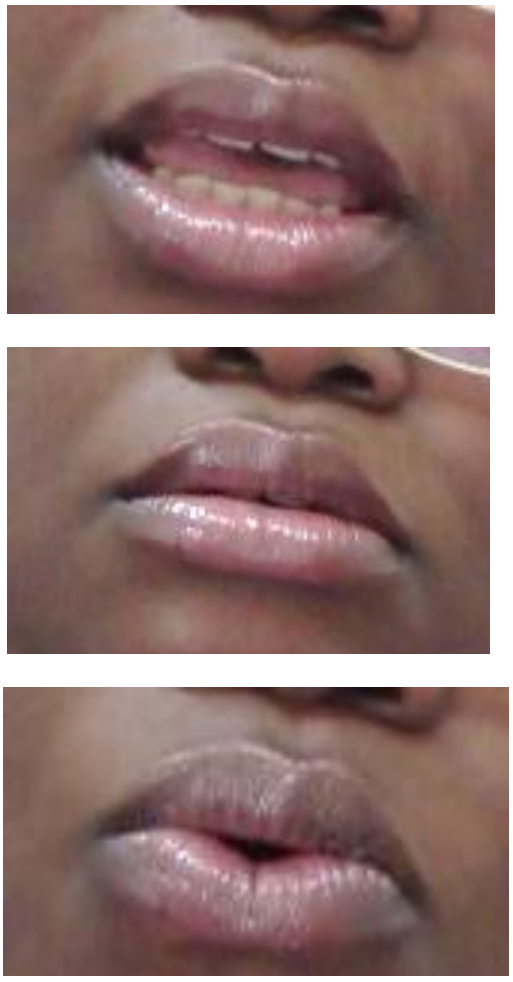


The vowel /ʉ̩/ is clearly central according to the vowel plot. However, it does not fit standard categories for vowel posture. The lips do not form a circular opening, and the corners of the mouth are not drawn together, as occurs in both protruded and compressed rounding postures.

We asked the speaker to produce the vowel /ʉ̩/ in isolation. In her articulation of the sound, she began by manoeuvring the lips in the direction of a protruded lip posture. However, she then pulled the corners of the lips away from each other and brought the upper and lower lips close to each other so that there was only a narrow slit opening between them. The final posture thus involves some labial tension, particularly at the corners of the mouth, and a small amount of protrusion.

Figure 3 compares the positioning of the mouth in the articulation of the vowels /i ʉ̩ u/ spoken in isolation at the point of maximal gesture of the lips. Note particularly the close lip aperture of /ʉ̩/ in comparison to /i/ and the lack of rounding of /ʉ̩/ in comparison to /u/.

Figure 3: The vowels /i, ʉ̩, u/ spoken in isolation.



7. DISCUSSION

Ladefoged & Maddieson [10] observe that "bilabial trills in linguistic use are almost always released into high rounded vowels" (which are usually back) and

that bilabial trills nearly always arise historically from a sequence such as *mbu.

The Medumba case suggests that these observations may need to be fine-tuned in two respects: backness and rounding. First is the preponderance of bilabial trills before central vowels rather than back ones. In all of the Cameroonian languages mentioned above, most occurrences of bilabial trills are before central vowels. Similar cases occur elsewhere: In both Wari' in Brazil [12] and Avava in Vanuatu [3], bilabial trills occur before the central vowel [ʉ] instead of [u].

Second, many discussions of lip position make a distinction between compressed and protruded vowels, both of which are generally treated as characteristics of lip rounding (e.g. [10]). In both cases, the corners of the lips are drawn together. However, as we've noted for the Medumba vowel /ụ/, the corners of the lips are drawn apart instead. As a result, the Medumba /ụ/ cannot be construed as rounded, but given the labial tension involved in its articulation, it cannot be construed as involving relaxed lips either.

One possible approach would be to follow Laver [11] in employing three independent lip position parameters: protrusion (involving a forward horizontal gesture of the lips), horizontal expansion or constriction of the interlabial space (i.e. the space between the lips), and vertical expansion or constriction of the interlabial space. In this view, the Medumba /ụ/ involves horizontal expansion as the corners of the lips are drawn apart, vertical compression resulting in a close lip aperture, and perhaps a small amount of protrusion. Okada [18] implicitly takes this approach when he considers the Japanese /u/ to be unrounded and yet have compressed lips.

8. CONCLUSION

The bilabial trills in Medumba display some characteristics similar to those previously described in the literature: initiation from a closed position, a short oral closure period when prenasalized, an average of two trill periods per token, an average duration for a trill period of about 40 ms, and occasional failure of trilling that results in friction.

The distribution of bilabial trills before vowels in Medumba suggests a refinement in our understanding of what triggers them: a following central vowel with a close lip aperture due to vertical compression (but no rounding) may be a more common environment than previously thought. We suggest that future work on bilabial trills should investigate this environment further.

9. ACKNOWLEDGMENTS

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